

UM11597

PCF2131-ARD evaluation board

Rev. 1.0 — 15 September 2021

User manual

Document information

Information	Content
Keywords	PCF2131, I ² C-bus, SPI-bus, Real Time Clock, RTC, Arduino port, Aardvark header, EVK
Abstract	The PCF2131-ARD evaluation board is a daughtercard equipped with Arduino port and Aardvark header, for easy test and design of PCF2131TF IC. The board is fully compliant with IMXRT1050 EVK, LPCXpresso55S69 and i.MX 8M Mini LPDDR4 EVK, including GUI software control.



Revision history

Rev	Date	Description
v.1	20210915	Initial version

IMPORTANT NOTICE**For engineering development or evaluation purposes only**

NXP provides the product under the following conditions:

This evaluation kit is for use of **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY**. It is provided as a sample IC pre-soldered to a printed-circuit board to make it easier to access inputs, outputs and supply terminals. This evaluation board may be used with any development system or other source of I/O signals by connecting it to the host MCU computer board via off-the-shelf cables. This evaluation board is not a Reference Design and is not intended to represent a final design recommendation for any particular application. Final device in an application heavily depends on proper printed-circuit board layout and heat sinking design as well as attention to supply filtering, transient suppression, and I/O signal quality.

The product provided may not be complete in terms of required design, marketing, and or manufacturing related protective considerations, including product safety measures typically found in the end device incorporating the product. Due to the open construction of the product, it is the responsibility of the user to take all appropriate precautions for electric discharge. In order to minimize risks associated with the customers' applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards. For any safety concerns, contact NXP sales and technical support services.

1 Introduction

This document describes the PCF2131-ARD evaluation board. The evaluation board is built around the PCF2131TF IC, a CMOS Real-Time Clock (RTC) and calendar with an integrated Temperature Compensated Crystal Oscillator (TCXO) and a 32.768 kHz quartz crystal optimized for very high accuracy and ultra-low power consumption. The PCF2131TF has a selectable I²C-bus or SPI-bus, a backup battery switch-over circuit, a programmable watchdog function, four timestamps function, and other features. For more details see the PCF2131TF datasheet. The PCF2131-ARD works as a daughtercard which can be connected through an Arduino port to various Arduino compatible (including original Arduino UNO R3) boards. Alternatively, the board can be connected through a dedicated connector to an Aardvark USB to I²C/SPI host adapter, allowing for rapid tests of the DUT IC. The board is equipped with a battery holder and an adjustable voltage regulator, allowing the user to test the RTC over the entire range of power supply voltage, and the battery switch-over circuit.

The evaluation board is intended to test and evaluate all characteristics of the silicon, such as I²C/SPI communication, power management, battery backup, timestamps, interrupts, and other internal features of the PCF2131 RTC.

Additionally, the daughterboard has software support and a graphical user interface (Windows platform) for the following NXP evaluation boards: IMXRT1050 EVK Board, LPCXpresso55S69 Development Board and i.MX 8M Mini LPDDR4 EVK Board. All three evaluation boards contain Arduino ports, allowing the user to attach and operate from the GUI the PCF2131-ARD daughterboard.

2 Finding kit resources and information on the NXP web site

NXP Semiconductors provides online resources for evaluation board and its supported device(s) on <http://www.nxp.com>.

The information page for the PCF2131-ARD evaluation board is at <http://www.nxp.com/PCF2131-ARD>. The information page provides overview information, documentation, software and tools, parametrics, ordering information and a **Getting Started** tab. The Getting Started tab provides quick-reference information applicable to using the PCF2131-ARD evaluation board, including the downloadable assets referenced in this document.

2.1 Collaborate in the NXP community

The NXP community is for sharing ideas and tips, ask and answer technical questions, and receive input on just about any embedded design topic.

The NXP community is at <http://community.nxp.com>.

3 Getting ready

Working with the PCF2131-ARD evaluation board requires the kit contents, additional hardware, and a Windows PC workstation with installed software.

3.1 Kit contents

- Assembled and tested evaluation board in an antistatic bag

- Quick Start Guide

3.2 Assumptions

Familiarity with the I²C and SPI bus is helpful but not required.

3.3 Static handling requirements

CAUTION



This device is sensitive to ElectroStatic Discharge (ESD). Therefore care should be taken during transport and handling. You must use a ground strap or touch the PC case or other grounded source before unpacking or handling the hardware.

3.4 Minimum system requirements

This evaluation board requires a Windows PC workstation. Meeting these minimum specifications should produce great results when working with this evaluation board.

- Computer with Windows 10
- One USB port (either 3.0 or 2.0 or 1.1 compatible)
- One of three EVK boards (MIMXRT1050-EVK, LPC55S69-EVK, 8MMINILPD4-EVK) along with the associated firmware / GUI software
- USB cable for power and data connection between PC and EVK board (if not included in the EVK package)

4 Getting to know the hardware

4.1 PCF2131-ARD evaluation board features

- Equipped with Arduino Uno R3 port for direct connection with Arduino devices
- On-board header for direct connection to Aardvark I²C/SPI Host Adapter
- Adjustable power supply for complex tests and verification
- On-board battery holder for battery switch-over circuit test
- On-board jumpers for I²C-bus or SPI-bus selection
- On-board connector and switches for timestamp function tests
- Fully compliant with IMXRT1050 EVK board, including GUI (Windows 10)
- Fully compliant with LPCXpresso55S69 development board, including GUI (Windows 10)
- Compliant with i.MX Mini LPDDR4 EVK board, including GUI (Windows 10)

Note: For i.MX Mini LPDDR4 EVK Board it is necessary to use an IMX8MMINI-IARD interposer board between the EVK and PCF2131-ARD daughterboard (see UM11612 IMX8MMINI-IARD User Manual).

4.2 Kit featured components

[Figure 1](#) identifies the main components on the board. The main elements are called out in the picture. The Arduino port connectors (J6, J7, J11, J12) are located on the bottom side of the board.

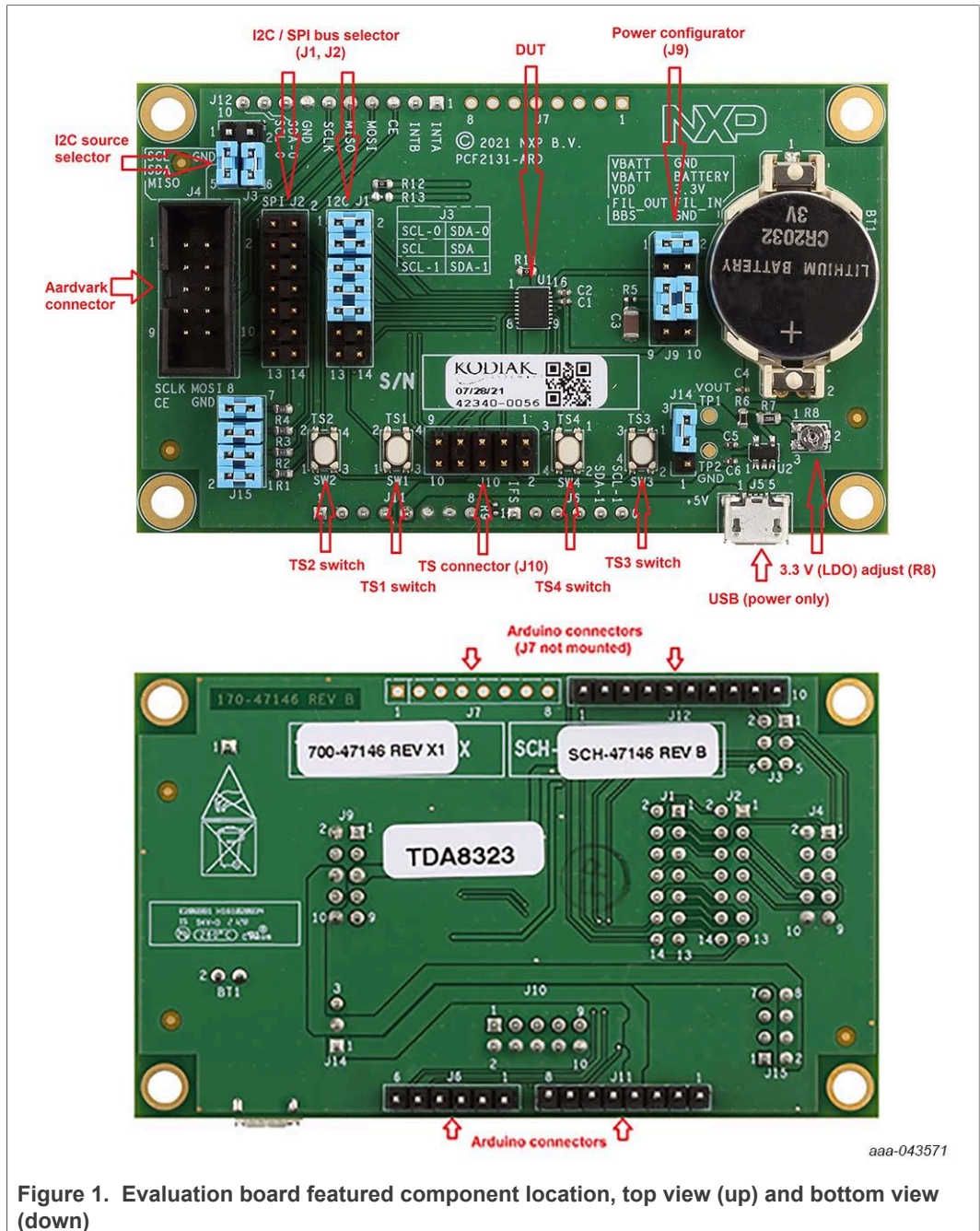


Figure 1. Evaluation board featured component location, top view (up) and bottom view (down)

4.3 Schematic, board layout and bill of materials

The schematic, board layout and bill of materials for the PCF2131-ARD evaluation board are available at <http://www.nxp.com/PCF2131-ARD>.

4.4 Arduino port

J6, J7, J11, and J12 are the mated pin headers of Arduino UNO R3 connectors, having the same electrical function and placed on the board, so that the daughterboard can be directly inserted in the Arduino port. Note that J7 is not mounted (since there is no signal

line used on this connector). See [Table 1](#) for the connector pin chart, and the lines used in the circuit.

Table 1. Pin chart of Arduino connectors

Ref Des	#	Arduino label	PCF2131-ARD function
J11 (Power)	1	NC	Not used
	2	IOREF	Not used
	3	RESET	Not used
	4	3.3V	3.3 V power supply
	5	5V	5 V power supply
	6	GND	Power supply return
	7	GND	Power supply return
	8	Vin	Not used
J6 (analog, digital, I²C)	1	A0	PCF_IFS
	2	A1	Not used
	3	A2	Not used
	4	A3	Not used
	5	A4 / SDA ^[1]	I2C_SDA_ARD_1
	6	A5 / SCL ^[1]	I2C_SCL_ARD_1
J7 (digital, UART, PWM) – not mounted -	1	D0 / RX	Not used
	2	D1 / TX	Not used
	3	D2	Not used
	4	D3 / PWM	Not used
	5	D4	Not used
	6	D5 / PWM	Not used
	7	D6 / PWM	Not used
	8	D7	Not used
J12 (mixed)	1	D8	PCF_INTA
	2	D9 / PWM	PCF_INTB
	3	D10 / SS / PWM	SPI_CE
	4	D11 / MOSI / PWM	SPI_MOSI
	5	D12 / MISO	SPI_MISO
	6	D13 / SCK	SPI_SCK
	7	GND	Power supply return
	8	AREF	Not used
	9	A4 / SDA ^[1]	I2C_SDA_ARD_0
	10	A5 / SCL ^[1]	I2C_SCL_ARD_0

[1] Select the I2C_ARD_0 / I2C_ARD_1 from jumper header J3.

4.5 I²C/SPI bus selection

The PCF2131TF can interface with an SPI or I²C interface. While SPI interface is selected, install jumpers on J2 across pins 1&2, 3&4, 5&6, 7&8, 9&10. While I²C interface is selected, install jumpers on J1 across pins 1&2, 3&4, 5&6, 7&8, 9&10. Placing a jumper across pins 1&2 on J1 or J2 shorts the IFS pin to either VDD (to select I²C interface) or GND (to select SPI interface).

J3 selects the I²C-bus source from Arduino interface (pins 9 and 10, connector J12, or pins 5 and 6, connector J6).

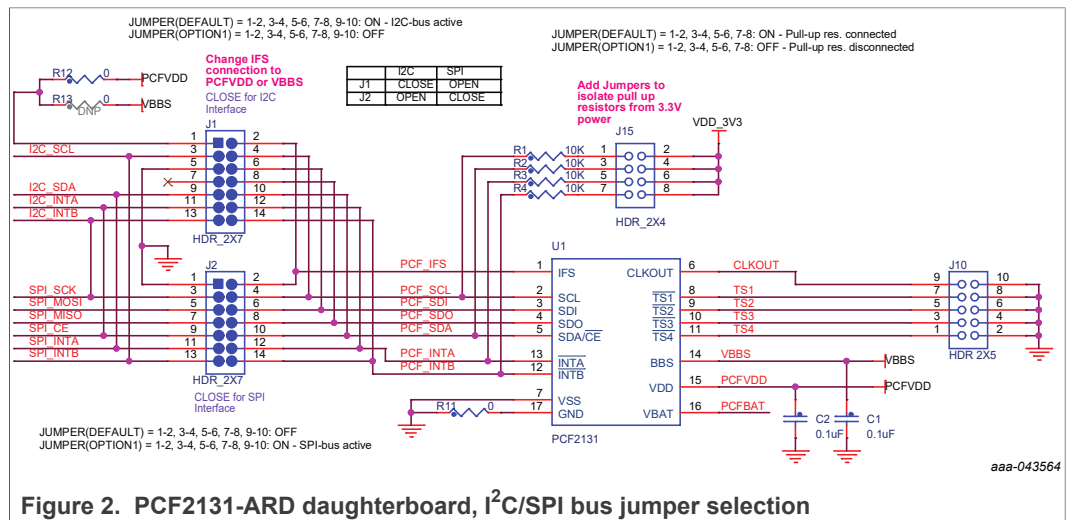


Figure 2. PCF2131-ARD daughterboard, I²C/SPI bus jumper selection

Note that interface selection should be done before the battery is supplied to VBAT pin. Once VBAT pin is powered, interface type can't be changed even with the jumpers moved from I²C locations to SPI locations, or vice versa. To select a new interface type:

1. Remove power supply to the evaluation board, and disconnect the VBAT pin from battery power by removing the jumper across J9.3&4, and placing a jumper across J9.1&2
2. Change Interface Jumpers to either SPI (J2) or I²C (J1)
3. Connect VBAT pin to battery power (remove the jumper across J9.1&2, and place a jumper across J9.3&4), and power the evaluation board again.

Table 2. I²C/SPI bus selection

J1 J2 Jumper Settings	J4 (Aardvark) I2C		J12 (Arduino) I2C		J4 (Aardvark) SPI		J12 (Arduino) SPI	
	J1 Jumpers	J2 Jumpers	J1 Jumpers	J2 Jumpers	J1 Jumpers	J2 Jumpers	J1 Jumpers	J2 Jumpers
1 = 2	1 2	1 = 2	1 2	1 2	1 2	1 = 2	1 2	1 = 2
3 = 4	3 4	3 = 4	3 4	3 4	3 4	3 = 4	3 4	3 = 4
5 = 6	5 6	5 = 6	5 6	5 6	5 6	5 = 6	5 6	5 = 6
7 = 8	7 8	7 = 8	7 8	7 8	7 8	7 = 8	7 8	7 = 8
9 = 10	9 10	9 = 10	9 10	9 10	9 10	9 = 10	9 10	9 = 10
11 = 12	11 12	11 = 12	11 12	11 12	11 12	11 = 12	11 12	11 = 12
13 = 14	13 14	13 = 14	13 14	13 14	13 14	13 = 14	13 14	13 = 14

Table 2. I²C/SPI bus selection...continued

Signal Active	J4.1 – I2C_SCL	J12.1 – INTA	J4.1 – INTB	J12.1 – INTA
	J4.3 – I2C_SDA	J12.2 – INTB	J4.3 – INTA	J12.2 – INTB
	J4.7 – INTB	J12.9 – I2C_SDA	J4.5 – SPI_MISO	J12.3 – SPI_CE
	J4.9 – INTA	J12.10 – I2C_SCL	J4.7 – SPI_SCK	J12.4 – SPI_MOSI
			J4.8 – SPI_MOSI	J12.5 – SPI_MISO
			J4.9 – SPI_CE	J12.6 – SPI_SCK

4.6 Aardvark header

Table 3. J4 (Aardvark header) pin chart

Wire label	J5		Wire label
I2C_SCL	1	2	GND
I2C_SDA	3	4	NC
SPI_MISO	5	6	NC
SPI_SCK	7	8	SPI_MOSI
SPI_CE	9	10	GND

The PCF2131-ARD daughtercard contains a dedicated header (J4) for direct connection with an Aardvark I²C/SPI Host Adapter. [Table 3](#) depicts the pin chart of the Aardvark header. For more details, see the Aardvark I²C / SPI Host Adapter from Total Phase (www.totalphase.com).

When an external interface cable (Aardvark or Promira) is used on J4, depending on the interface selected, user should also place jumpers across all pins on either J1 (I2C) or J2 (SPI). The user must be sure the board is properly powered, and the Arduino interface is not used, to avoid signal conflicts. INTA and INTB signals are routed to the other interface pins that should be repurposed as GPIO functions.

However, when using the Arduino connector, there are two dedicated pins already assigned for INTA (J12.1) and INTB (J12.2). It is not necessary to close the jumpers across 11&12 and 13&14 on J1 or J2 to route interrupt signals to the other interface pins.

4.7 Timestamp connector and toggle switches

[Figure 3](#) depicts the timestamp section of the PCF2131-ARD schematic diagram. The four dedicated inputs for timestamp (TS) of the DUT are pins 8 to 11. On the TS inputs, toggle switches SW1 to SW4 are connected. Simultaneously, the inputs are linked to J10 connector, so that the user can use either on-board switches or external devices for the timestamp test.

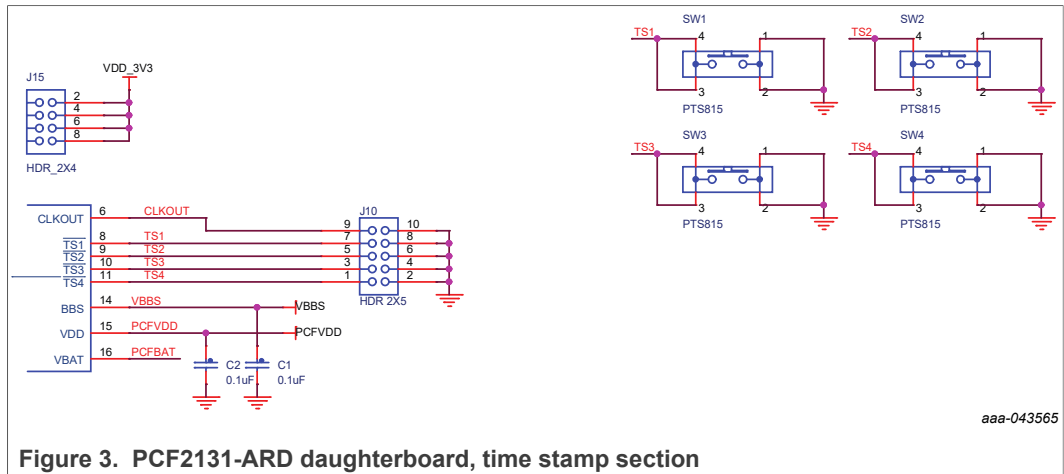


Figure 3. PCF2131-ARD daughterboard, time stamp section

4.8 Power supply

Figure 4 represents the J9 section of the PCF2131-ARD schematic diagram.

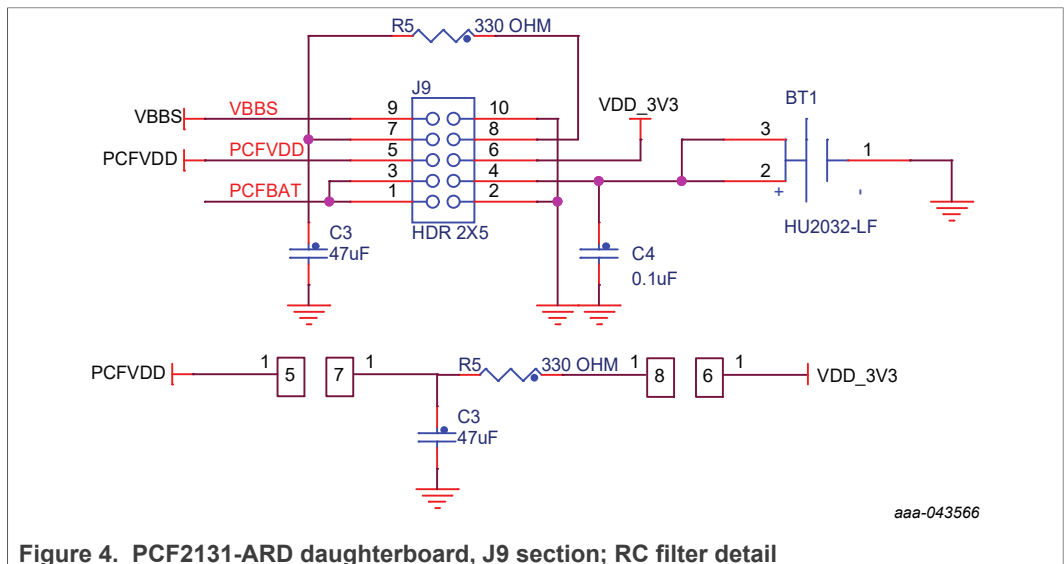


Figure 4. PCF2131-ARD daughterboard, J9 section; RC filter detail

J9 has several functions to configure the power rails feeding into PCX2131TF

1. Battery power (VBAT) connection:
When the evaluation board is provided, VBAT pin is grounded with a jumper placed across J9.1&2. After interface selection (by placing jumpers on J1 or J2), user can move this jumper to J9.3&4 to connect battery power to VBAT pin.
2. VDD connection:
User can evaluate to have a R/C filter placed before the VDD pin, or bypass the R/C filter and directly feed VDD_3V3 to VDD pin.
By default, the R/C filter is recommended, and jumpers are placed across J9.6&8, J9.5&7. The overall circuit is illustrated Figure 5.
To bypass the R/C filter, place a jumper across J9.5&6.
To measure current consumption, remove the jumper across J9.5&7, and place a current meter across these two pins.
In some cases, the interface dongle itself can provide its own pullup resistors. If a dongle is used with this EVM on J4, PCX2131TF could be powered through the

dongle pullup resistors, and cause the ramp up time on the VDD to change. The overall power path is illustrated below.

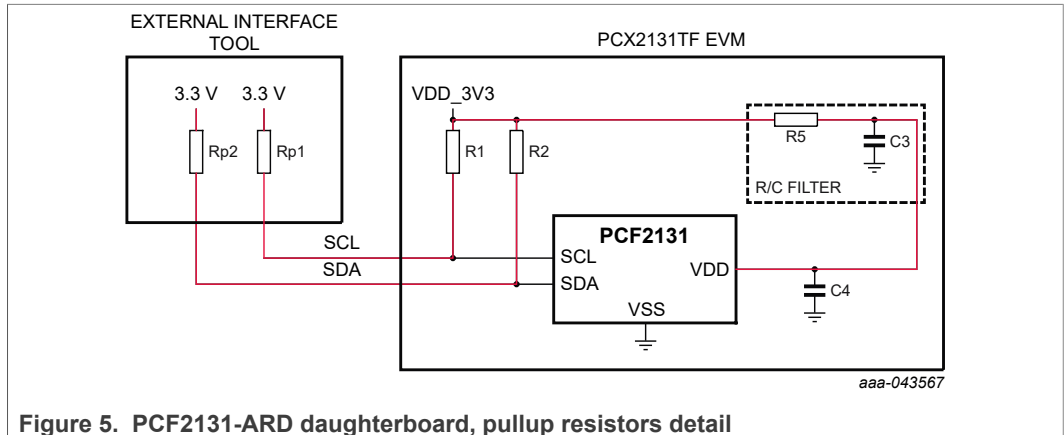


Figure 5. PCF2131-ARD daughterboard, pullup resistors detail

To prevent the dongle from back powering the EVM, the following should be performed by the user (see Figure 6):

- The interface dongle should be plugged into the EVM after PCX2131TF or EVM is powered up.
- If a user desires to keep the interface dongle plugged in regardless of the power state of PCX2131TF, the following steps are recommended:
 - Disable the interface dongle’s pullup resistors on the interface pins (SCL/SDA), either through hardware or software control. Use onboard interface pullup resistors R1 and R2.
 - If the interface dongle’s pullup resistors can’t be disabled, remove the jumpers on J15 1&2, and 3&4 on the EVM board.

3. BBS monitor:

BBS pin output can be monitored on J9.9

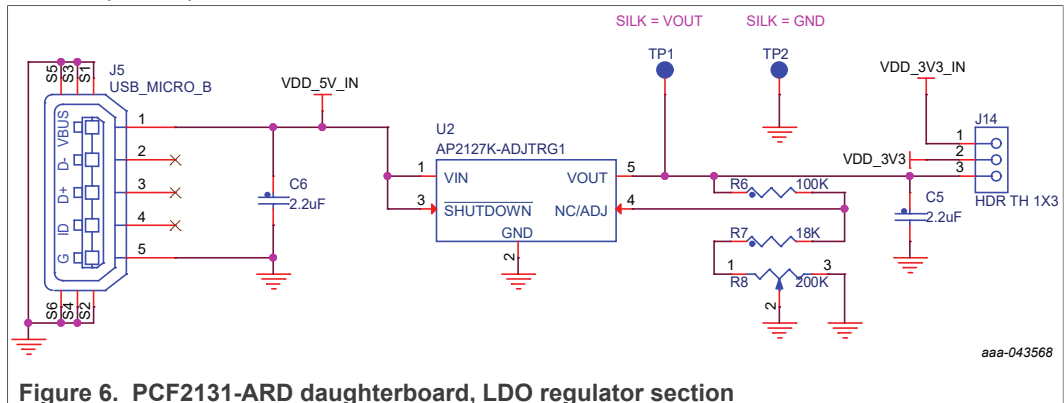


Figure 6. PCF2131-ARD daughterboard, LDO regulator section

PCX2131TF evaluation board can be powered through two different power sources, either from Arduino header’s 3.3V directly by selecting J14.1&2, or from an external micro USB (J5, 5V input) through an adjustable LDO by selecting J14.2&3 (Figure 6). Note that the Arduino header only supplies fixed 3.3V, and might not be suitable for evaluating a different power supply range. The on-board LDO can adjust the output voltage from 1.2V to 5V.

Table 4 summarizes which source to use for different evaluation purposes.

Table 4. Power supply selection

Arduino 3.3 V J14.1&2	Adjustable VDD J14.2&3	Purposes
Yes		When using a microcontroller with Arduino header, and VDD is fixed to 3.3V
	Yes	When using an Aardvark/FTDI_C232HM platform as host interface controller. VDD = 3.3V
	Yes	When using an Promira platform as host interface controller. VDD can be adjusted to 1.2V, 1.8V, 2.5V, 3.3V, and 5V to match with Promira's level shift command.

5 Installing and configuring software tools

PCF2131-ARD evaluation board is designed and built as a daughterboard able to work in conjunction with a motherboard equipped with an Arduino port. The board is fully compatible with the following NXP Evaluation (EVK) boards:

- IMXRT1050 EVK Board
- LPCXpresso55S69 Development Board
- i.MX 8M Mini LPDDR4 EVK Board

Each of the evaluation/development boards benefits from firmware support which can be downloaded from www.nxp.com. Before starting, the EVK motherboard must be programmed with the corresponding firmware package. Additionally, a GUI application (Windows 10) is also available for download, allowing rapid testing and operation of the PCF2131-ARD daughterboard through the one of above mentioned EVKs.

For details regarding installation of the EVK firmware and GUI host software on PC, download the EVK_Firmware_And_GUI_Install_Guide_For_Arduino_Boards.pdf instruction file from www.nxp.com. Once the software is installed, the first step is to select from the graphical interface the correct combination EVK – PCF2131-ARD daughtercard, and then the board can be controlled from the GUI interface. See [Section 6](#) and [Section 7](#) for more details regarding the operation of PCF2131-ARD from GUI software.

6 Configuring the hardware

6.1 PCF2131-ARD initial hardware setup

The following steps are suggested to setup the hardware before first use:

1. Select the communication bus
 - a. Select the I²C-bus Arduino source (J3)
 - b. Select interface jumpers, either using I2C interface (J1) or SPI interface (J2)
2. Place coin battery CR2032 into BT1 battery socket
3. Remove jumper on J9.1&2, and move it to J9.3&4
4. Select correct power supply source on J14. (1&2) = Arduino, (2&3) = Micro USB

5. Connect power and host controller
 - a. Apply 5V power to J5 using a micro USB cable and plug in Aardvark/Promira/FTDI host controller cable to J4. **(Note: Make sure 5V supply is plugged in before connecting the host controller cable).**
 - b. Or Plug J11 and J12 into a microcontroller’s Arduino headers and supply the microcontroller kit with USB power through the PC.

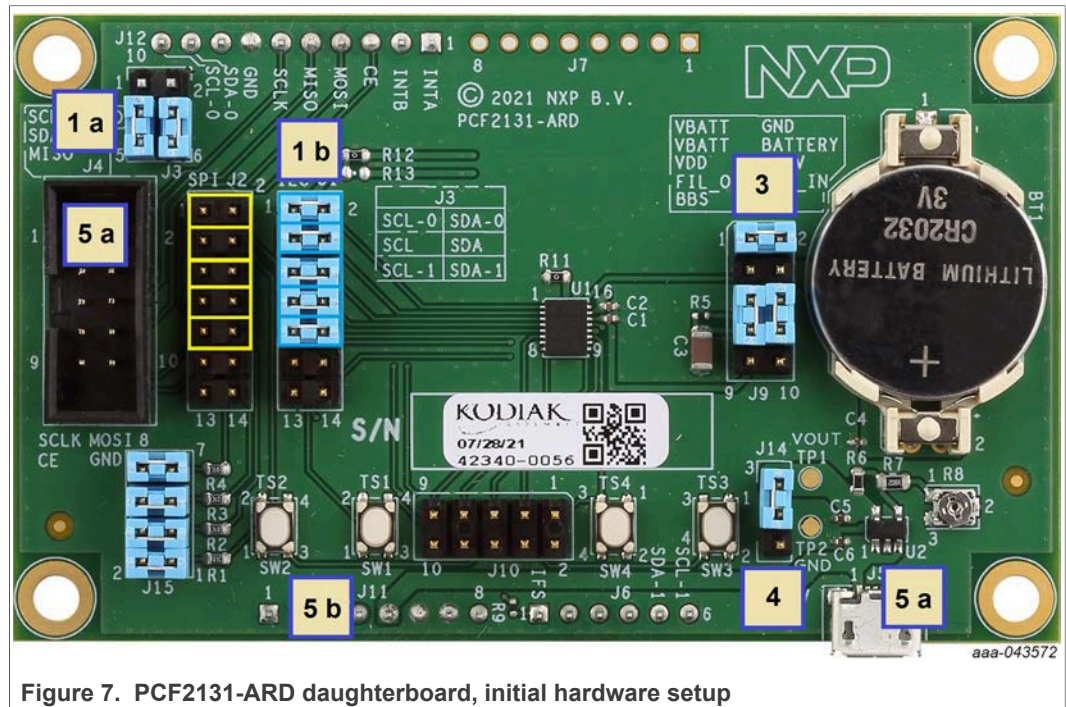


Figure 7. PCF2131-ARD daughterboard, initial hardware setup

6.1.1 Using PCF2131-ARD with IMXRT1050 EVK board

Figure 8 shows the required hardware for operation of the PCF2131-ARD daughterboard with IMXRT1050 EVK. The following items are necessary:

- One IMXRT1050-EVK board
- One PCF2131-ARD daughterboard
- One USB-A / USB Micro-B cable
- A PC with Windows 10 operating system

The IMXRT1050 EVK motherboard can be powered by one of three methods:

1. Connecting an external 5VDC power supply to the barrel power connector (J2) on the board
2. Connecting a USB cable from the PC to the Micro-B USB connector (J9) on the board
3. Connecting a USB cable from the PC to the USB connector (J28) on the board. When the PC is connected in this fashion, the USB port can simultaneously act as a debug interface. Therefore, by using a single USB cable connected to J28, the EVK can be powered and at the same time linked to the PC for data exchange.

The older USB ports (from PC) are not able to deliver the necessary current (500mA); before establishing the communication, use an external power supply (connected to J2).

From J1 on the EVK board (see Figure 6) the user can select the power configuration for the motherboard. For further details, download the IMXRT1050 EVK Board Hardware

User Guide available at <https://www.nxp.com/design/development-boards/i-mx-evaluation-and-development-boards/i-mx-rt1050-evaluation-kit:MIMXRT1050-EVK>.

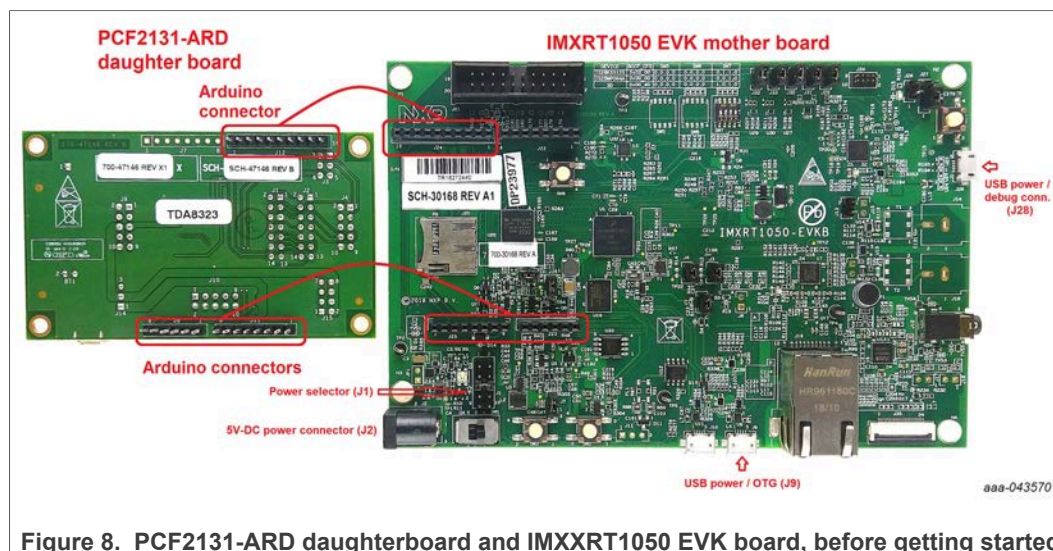


Figure 8. PCF2131-ARD daughterboard and IMXRT1050 EVK board, before getting started

To configure the hardware and workstation, complete the following procedure:

- Configure the suitable power configuration of EVK (J1). If using J28 for power supply, the J1 jumper is placed in position 5-6. If using an external power supply (connected to J2), the jumper J1 is placed in position 1-2.
- Insert the PCF2131-ARD daughtercard on the Arduino connector of the EVK (see [Figure 8](#)).
- Using USB connector J28, connect the EVK board to a USB port of the computer.
- Install the IMXRT1050 target firmware (download from NXP site and see UM11581, [Arduino shields GUI and firmware installation manual](#) for step-by-step instructions).
- Install GUI application (see [UM11581, Arduino shields GUI and firmware installation manual](#)).
- Open the GUI application to operate the device from the PC. For details regarding GUI operation see [Section 7](#).

[Figure 9](#) shows the boards during the operation.

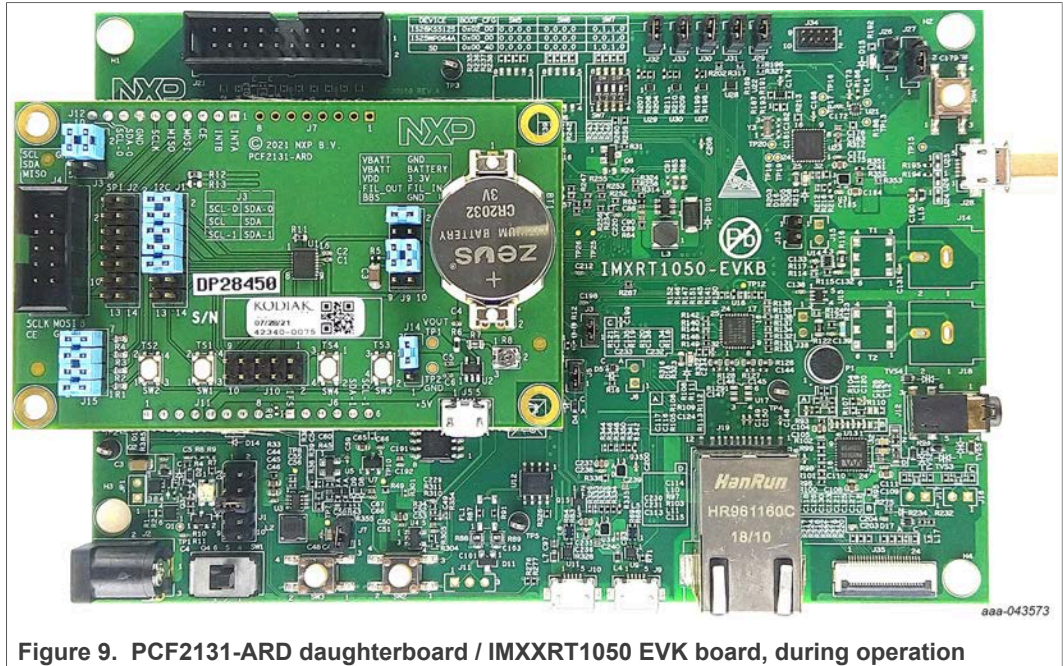


Figure 9. PCF2131-ARD daughterboard / IMXXRT1050 EVK board, during operation

6.1.2 Using PCF2131-ARD with LPCXpresso55S69 development board

Figure 10 shows the required hardware for operation of the PCF2131-ARD and LPCXpresso55S69 EVK board. This configuration consists of:

- One LPCXpresso55S69 EVK board
- One PCF2131-ARD daughterboard
- One USB-A / USB Micro-B cable
- A PC with Windows 10 operating system

The LPCXpresso55S69 development board is equipped with four USB Micro-B connectors: P5, P6, P9 and P10. The board can be powered through any USB port. Using P6 USB connector to connect the board to the PC simplifies the start-up operation because P6 is designated for debugging and the USB cable thus accomplishes two tasks at the same time: powering the board, and serving as a data link between the EVK board and PC. For more details regarding power-up and operation of the LPCXpresso55S69 development board, see the *LPCXpresso55S69/LPCXpresso55S28 Development Board User Manual* <https://www.nxp.com/design/development-boards/lpcxpresso-boards/lpcxpresso55s69-development-board:LPC55S69-EVK>.

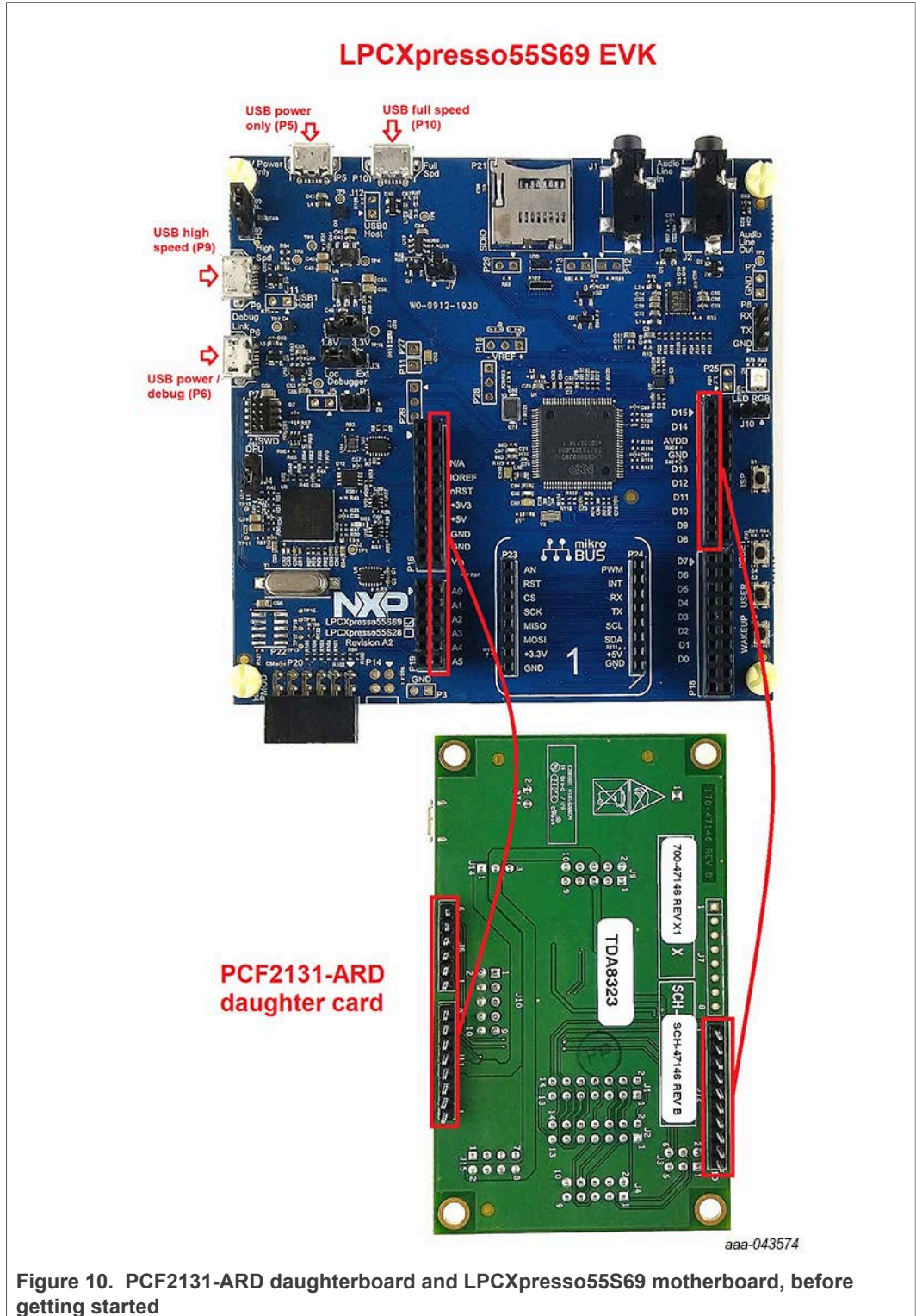


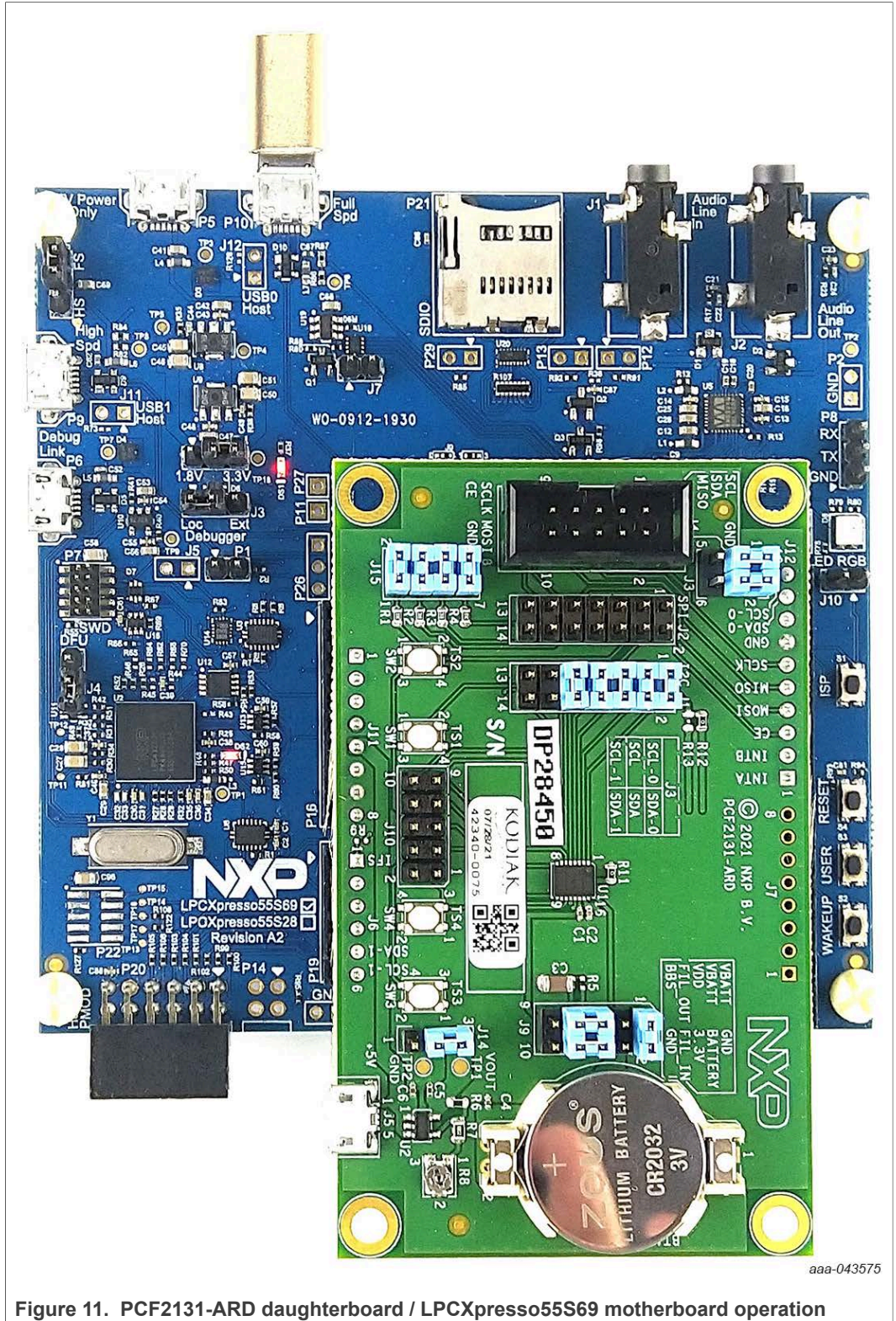
Figure 10. PCF2131-ARD daughterboard and LPCXpresso55S69 motherboard, before getting started

The following steps describe the hardware assembly operations, powering up, programming and operating the setup assembly:

- Insert the PCF2131-ARD daughtercard to P16 – P19 connectors located on LPCXpresso55S69 development board (see the marked pins of P16 – P19, [Figure 10](#))

- Connect the development board using port P10 USB port of PC
- Install the LPCXpresso55S69 target firmware (please download from NXP site and read the EVK_Firmware_And_GUI_Install_Guide_For_Arduino_Boards.pdf instruction file)
- Install GUI application on PC (see the same instruction file)
- Open the GUI application to operate the device from the PC. For details regarding GUI operation see [Section 7](#)

[Figure 11](#) shows the boards during operation.



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Figure 11. PCF2131-ARD daughterboard / LPCXpresso55S69 motherboard operation

6.1.3 Using PCF2131-ARD with i.MX 8M Mini LPDDR4 EVK board

When an i.MX 8M Mini LPDDR4 EVK board is used with the PCF2131-ARD board, a third board (IMX8MMINI-IARD interposer board) must be used, designed and built as an EVK – daughterboard interconnection. The EVK board i.MX 8M Mini LPDDR4 is not equipped with an Arduino port; instead it has a 2 x 20 pin expansion connector (J1003, see i.MX 8M Mini LPDDR4 EVK user manual). J1003 is a multipurpose port, containing various digital I/O lines, including specialized I²C and SPI buses. Starting from the expansion connector pin chart, an Arduino port interposer board was developed, with the role of signal-to-signal bridge between the 2 x 20 connector pins on the i.MX 8M Mini LPDDR4 EVK and the mated connectors of the Arduino port present on the PCF2131-ARD daughterboard.

To operate the setup, along with the EVK and the daughterboard, a third board must be included in the setup assembly. [Figure 12](#) shows the necessary boards and how these boards are connected. The configuration consists of:

- One i.MX 8M Mini LPDDR4 EVK board
- One PCF2131-ARD daughterboard
- One IMX8MMINI-IARD interposer board
- One USB-A / USB-C cable
- One USB-A / USB Micro-B cable
- A PC with Windows 10 operating system

It is recommended to attach the PCF2131-ARD to the Arduino connectors of the IMX8MMINI-IARD interposer board first, and then the resulting assembly to the i.MX 8M Mini LPDDR4 EVK. This can be done by plugging J1 connector located on the interposer board to J1003 connector on the EVK.

To power-up the EVK, a USB-C type cable connected to PORT 2 of the EVK is used. The power switch SW101 on the EVK board must be set to ON position to power-up the setup. Data communication is achieved by routing a separate USB (Micro-B type) cable from a USB port on the PC to debug port (J901) on the EVK (see [Figure 12](#) and [Figure 13](#)).

Details regarding power-up and operation of the setup assembly can be found in the 8MMINILPDDR4-EVK user manual and IMX8MMINI-IARD User Manual. The files can be downloaded from www.nxp.com/.

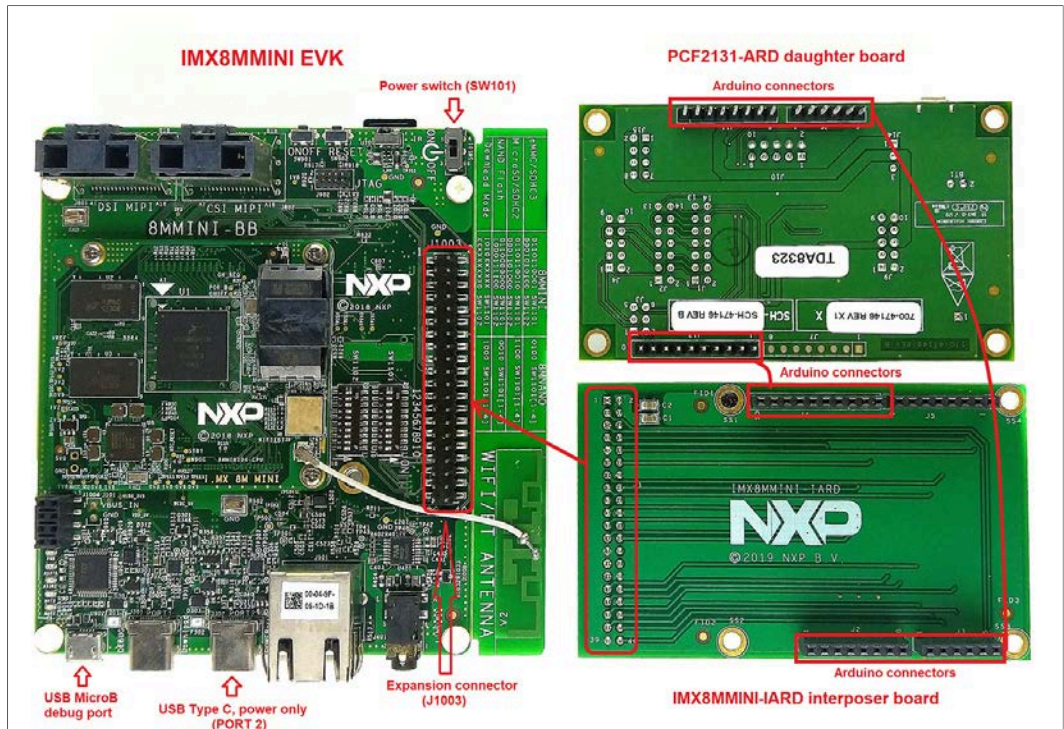


Figure 12. The assembly PCF2131-ARD daughterboard, IMX8MMINI-IARD interposer board, and i.MX 8M Mini LPDDR4 EVK, before getting to start

To configure and operate the setup:

1. Insert the PCF2131-ARD onto the IMX8MMINI-IARD interposer board Arduino connectors (located on the top side)
2. Attach IMXMMINI-IARD connector plug J1 (located on the bottom of the board) into J1003 expansion board located on the top side of i.MX 8M Mini LPDDR4 EVK (see [Figure 12](#))
3. Power-up the EVK board using a USB Type-C cable attached to PORT 2
4. Connect the EVK to the PC, using a USB Micro-B cable, attached to J901 debug port
5. Place SW101 in ON position to power-up the boards
6. Install the MIMXRT1050 target firmware ([UM11581, Arduino shields GUI and firmware installation manual](#))
7. Install GUI application on the PC (see the instruction file referred in the above step)
8. Open the GUI application to operate the device from the PC. For details regarding GUI operation see [Section 7](#)

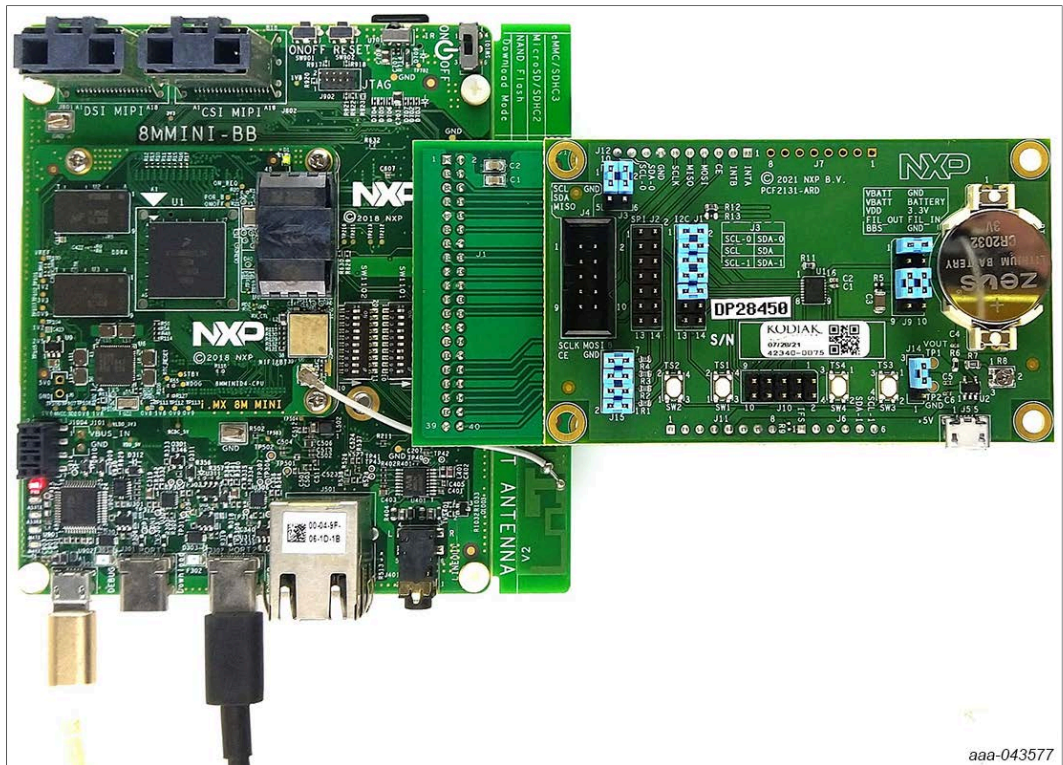


Figure 13. PCF2131-ARD daughterboard / i.MX 8M Mini LPDDR4 EVK board operation

6.1.4 Using PCF2131-ARD with another Arduino device

The PCF2131-ARD daughterboard can be operated with a different EVK board, which has an Arduino port. There are two options to connect the board: using an EVK equipped with an Arduino port, and an EVK without an Arduino port. In the first case, a firmware shall be developed according with PCF2131TF specifications, and then simply attach PCF2131-ARD daughterboard to the EVK, to operate the board. In the second case, using the pin chart of Arduino connectors (Table 1), make the necessary electrical connections (for power, I²C-bus or SPI-bus and interrupt control lines), and develop the desired firmware, assuring that is compliant with IC specifications. Use PCF2131TF datasheet to read details about internal registers of PCF2131TF and data exchange between internal controller and the EVK. Ensure the electrical connections are correct and avoid data conflicts on the signal lines to prevent IC damage.

6.1.5 Using PCF2131-ARD with Aardvark I²C/SPI Host Adapter

The PCF2131-ARD evaluation board can be controlled with the Aardvark I²C/SPI host adapter from Total Phase. The daughterboard contains the dedicated Aardvark connector (J4), so the host adapter can be directly connected to the daughterboard through J4 header, as shown in Figure 14. The pin chart of J4 is detailed in Table 3. The Aardvark I²C/SPI host adapter, along with the software tools (dynamic linked library, control center API) from Total Phase represents a powerful tool to test and develop devices and systems which use I²C and SPI standard protocols.

Note: The user must provide power through the USB connector (J5), or Arduino interface (J11), before operating the daughterboard with the Aardvark host adapter. In Figure 14 the power is provided through the USB connector.



Figure 14. PCF2131-ARD daughterboard connected to Aardvark I²C / SPI host adapter

7 GUI description

This section describes the GUI application for the three mentioned EVKs and how the user can control the PCF2131-ARD daughterboard from the graphical interface. First, install the GUI package and software on the PC (Windows 10). For more details, see [UM11581](#).

Once installation is complete, assure that one of the three EVKs with attached PCF2131-ARD daughterboard is connected to a PC and powered-on. Open PCF2131 RTC GUI application. An interface appears as shown in [Figure 15](#):

The GUI application starts with **Settings** tab (marked with red arrow). The left side of the window displays the following settings:

- **COM port:** displays port selected for the communication. The port is automatically selected by the system (in the picture is COM 39).
- **I2C speed:** displays the I²C-bus clock frequency (100 kHz, and 400 kHz).
- **SPI Speed:** displays the SPI-bus clock frequency (2 MHz, and 6 MHz).
- **I2C and SPI buttons:** allows the user to select the type of communication.
- **Connect:** initiate the connection to the EVK / daughterboard device.
- **Init Board:** initiate the daughterboard.

In the right side of the window is located **Device settings** field. The following settings are provided:

- **SW Reset (SR):** initiate the software reset.
- **CLR Prescaler (CPR):** clear the Prescaler register.
- **CLR Timestamp CTS):** clear the Timestamp register.
- **Hour Mode:** select the hour display mode (12 / 24).
- **Int A/B Mode:** select the interrupt type of signal (voltage level / pulse).
- **100th Seconds Counter:** enable / disable the 100th seconds counter
- **Read:** allow the user to read the internal registers of the DUT.

Near to each button (on the right side, or under) the register address and the bit number is displayed. See the PCF2131TF datasheet for more details about register map of the DUT IC.

In the bottom side of the GUI window a log window displays the communication process between the PC and the EVK / daughterboard device. The window can be cleared from

Clear **Log** button. A status bar located in the bottom side of the interface shows in real time the status connection between PC and the EVK.

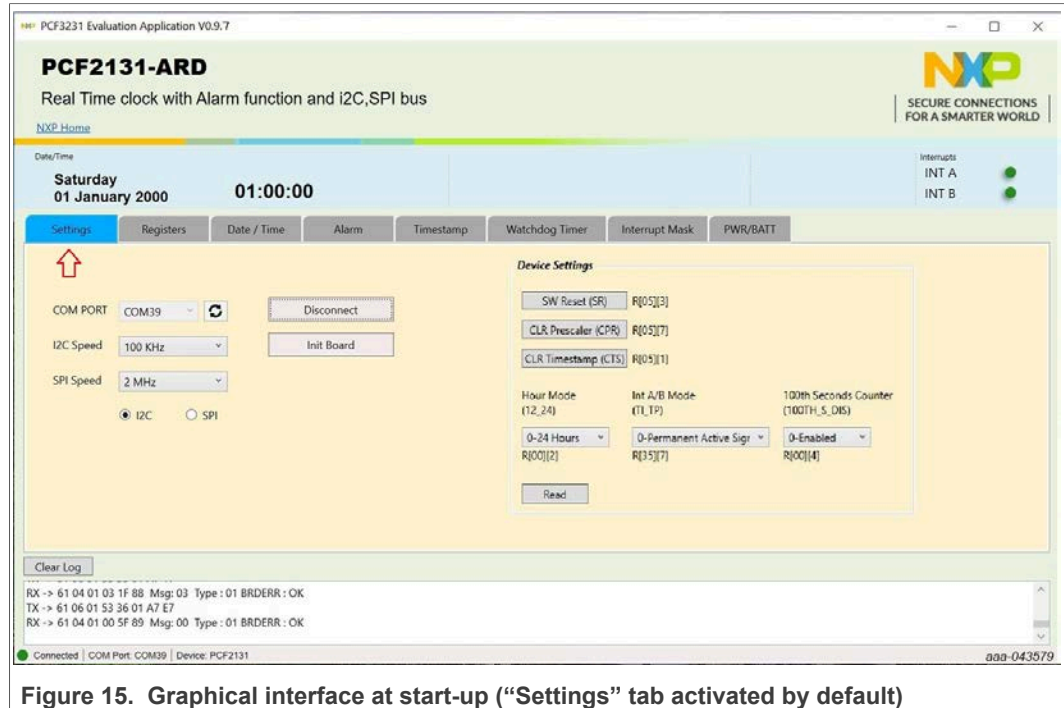


Figure 15. Graphical interface at start-up (“Settings” tab activated by default)

The next tab is **Register** (Figure 16). When selected, the user can directly write the internal registers of the PCF2131 IC. The following commands are available from this window:

- **Read:** read the information from the preselected internal register of PCF2131TF. The information is displayed in the Data window.
- **Write:** write the data to the preselected register address, of the PCF2131 RTC.
- **Send serial commands:** The registers can be written manually with the corresponding serial commands. See the PCF2131 datasheet to see more details regarding communication protocol of the DUT.

A table with the internal registers of the PCF2131 IC is displayed. Under the register table are the following commands (buttons):

- **Read Registers:** update the register table.
- **Save To File:** save the information of the register table into a .rcfg file.

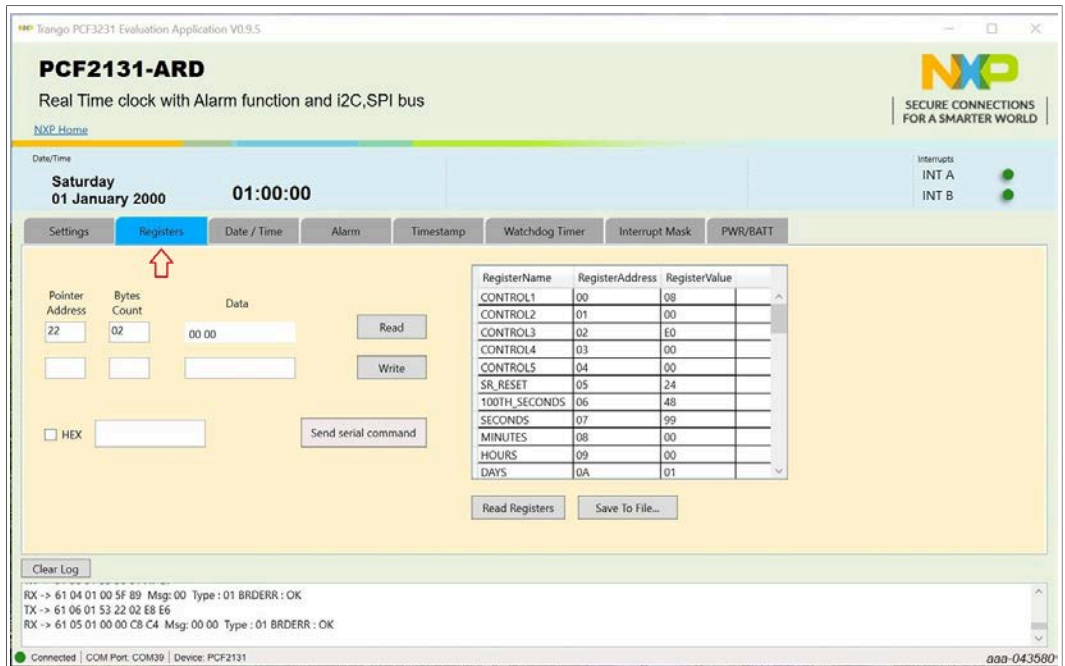


Figure 16. Graphical interface – “Registers” tab activated

Figure 17 shows the graphical interface when **Date/Time** is activated. From this tab the user can set the date and the time of the RTC. The information is displayed in the upper blue section of the window. The user can read the data from the RTC internal registers, with the **Read** button, or set the automatic update using **Poll Mode** button. The user can write the time / date of the RTC with the current values of the PC by clicking the **Set PC Time**.

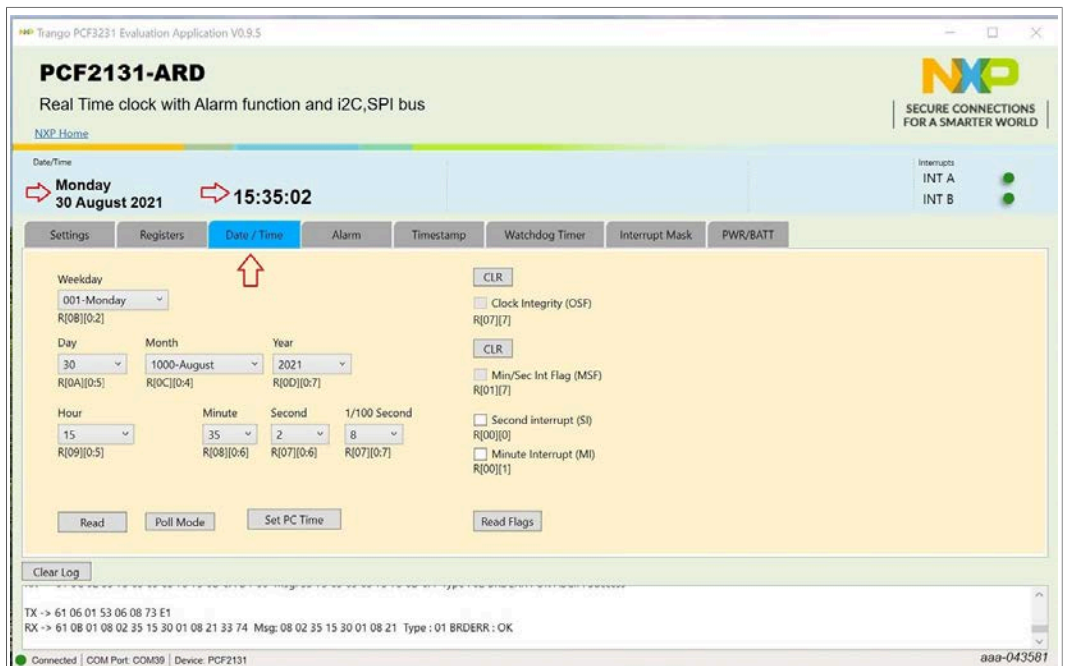


Figure 17. Graphical interface – “Date/Time” tab activated

The next tab is **Alarm**. The interface of this tab is shown in [Figure 18](#). From here the alarm corresponding registers can be managed. See the PCF2131 datasheet to see more details regarding the alarm function and register map of the DUT IC. Note that for each command / button the register address is displayed on the interface, so that the user can easily identify the register function in the register map, described in the PCF2131 datasheet.

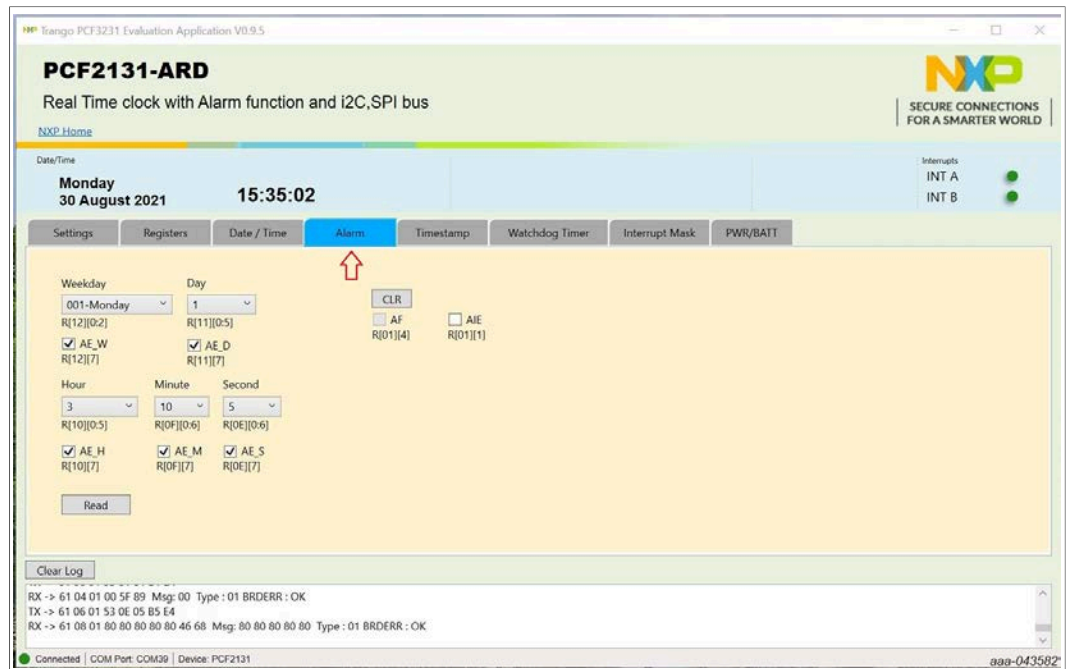


Figure 18. Graphical interface – “Alarm” tab activated

The following tabs are listed below:

- **Timestamp:** [Figure 19](#). See the datasheet for more details regarding timestamp functions of PCF2131 RTC.
- **Watchdog Timer:** [Figure 20](#). See the datasheet for more details regarding watchdog timer.
- **Interrupt Mask:** [Figure 21](#). On the upper blue region, right side, two indicators are monitoring in real-time the state of the INTA / INTB interrupts of the DUT IC. Note that, checking all boxes means the interrupts are fully masked, INTA / INTB are not active.
- **PWR/BATT:** [Figure 22](#). See the datasheet for more details regarding power management of the PCF2131 RTC.

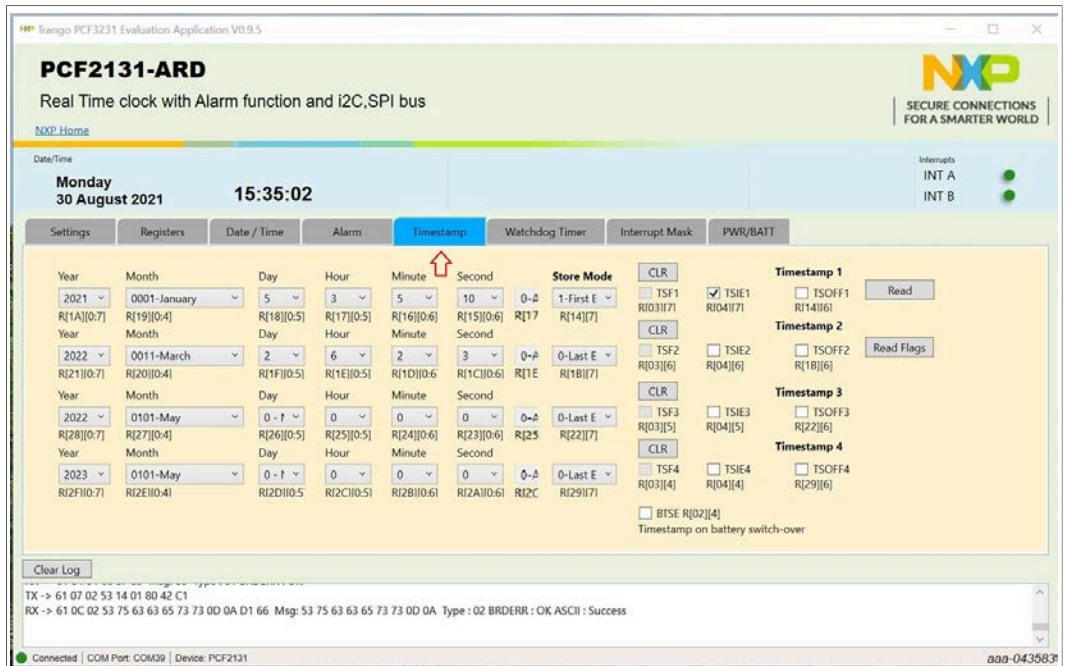


Figure 19. Graphical interface – “Timestamp” tab activated

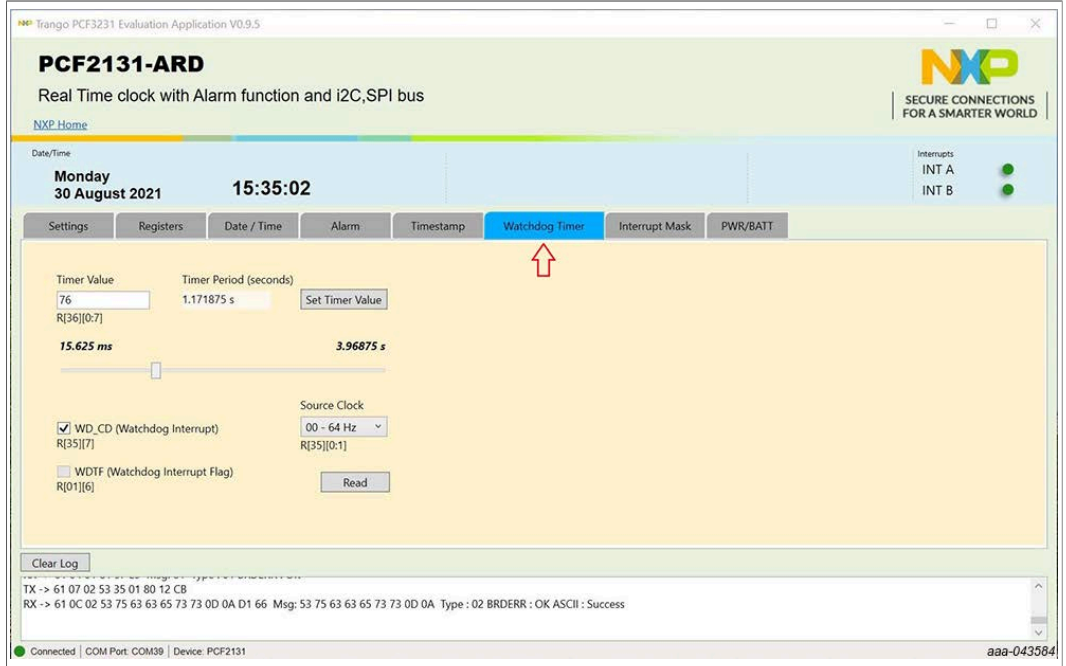


Figure 20. Graphical interface – “Watchdog Timer” tab activated

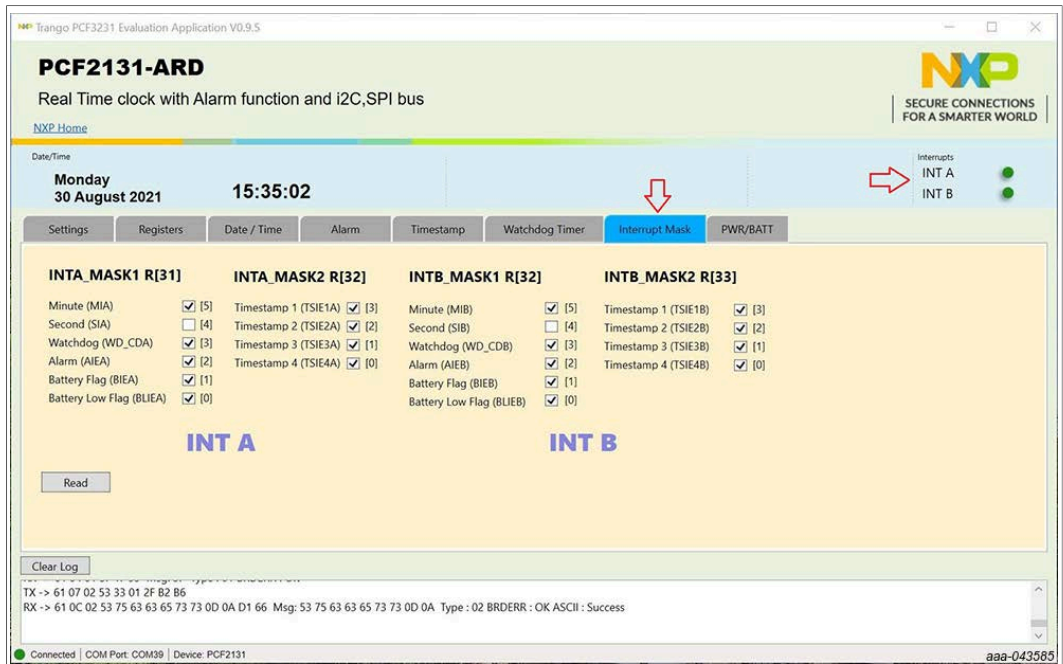


Figure 21. Graphical interface – “Interrupt Mask” tab activated

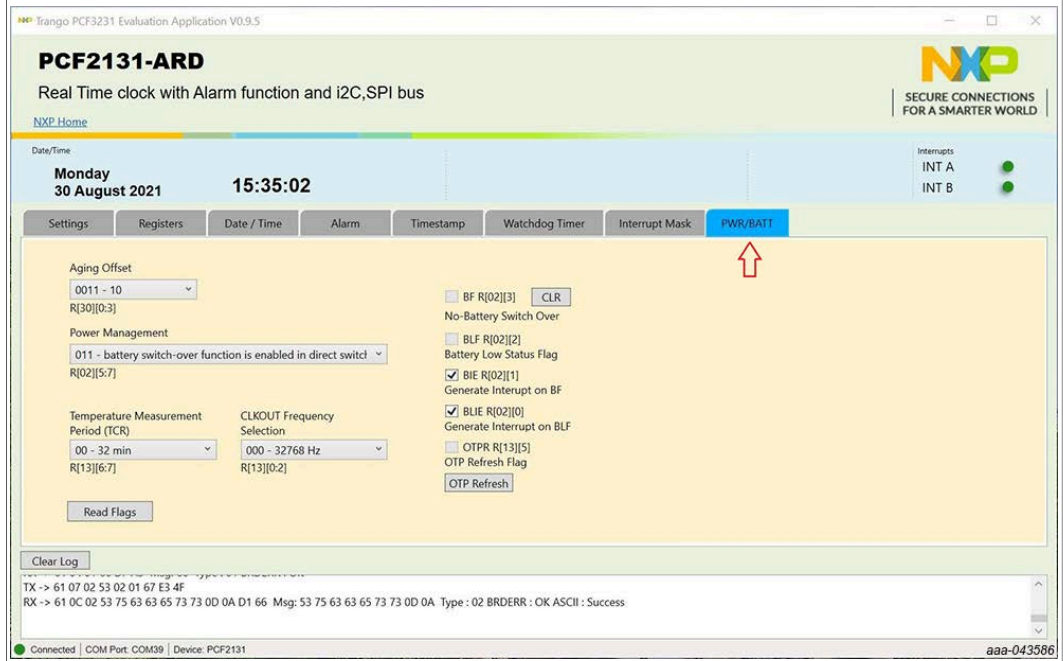


Figure 22. Graphical interface – “PWR/BATT” tab activated

8 Abbreviations

Table 5. Abbreviations

Acronym	Description
DUT	Device Under Test
ESD	Electro Static Discharge

Table 5. Abbreviations...continued

Acronym	Description
EVK	Evaluation Board
GUI	Graphical User Interface
I ² C-bus	Inter-Integrated Circuit bus
SPI-bus	Serial Peripheral Interface
IC	Integrated Circuit
LED	Light Emitting Diode
PC	Personal Computer
RTC	Real-Time Clock
USB	Universal Serial Bus

9 References

1. *PCF2131, Highly accurate nano-power RTC with integrated quartz crystal(Rev. 1.0 – 12 May 2021)*; Product data sheet; NXP Semiconductors;
2. *MIMxrt1050 EVK Board Hardware User's Guide* User manual; NXP Semiconductors;
3. *i.MX RT1050 Crossover Processors Data Sheet for Consumer Products* Data sheet; NXP Semiconductors;
4. *UM11158 – LPCXpresso55S69 Development Board* User manual; NXP Semiconductors;
5. *LPC556x 32-bit ARM Cortex-M33; M33 coprocessor, TrustZone, PowerQuad, CASPER, 320KB SRAM; 640 KB flash, USB HS, Flexcomm Interface, SDIO, 32-bit counter/timers, SCTimer/PWM, PLU, 16-bit 1.0 Msamples/sec ADC, Comparator, Temperature Sensor, AES, PUF, SHA, CRC, RNG* Product data sheet; NXP Semiconductors;
6. *i.MX 8M Mini LPDDR4 EVK Board Hardware User's Guide* User guide; NXP Semiconductors;
7. *i.MX 8M Mini Application Processor Datasheet for Consumer Products* Data sheet; NXP Semiconductors;
8. *i.MX 8M Mini Application Processor Reference Manual* Reference manual; NXP Semiconductors;
9. *Arduino Uno R3 Reference Manual* Reference manual; NXP Semiconductors;
10. *IMX8MMINI-IARD interposer board User Manual* User manual; NXP Semiconductors;
11. *NXP EVK Firmware and GUI Installation Guide for Arduino Series Boards* User manual; NXP Semiconductors;
12. *Aardvark I2C/SPI Host Adapter User Manual (v5.15 – February 28, 2014)*, Total Phase

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